CWRF Overview of the Forecasting Capabilities in UMD

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Maryland Health

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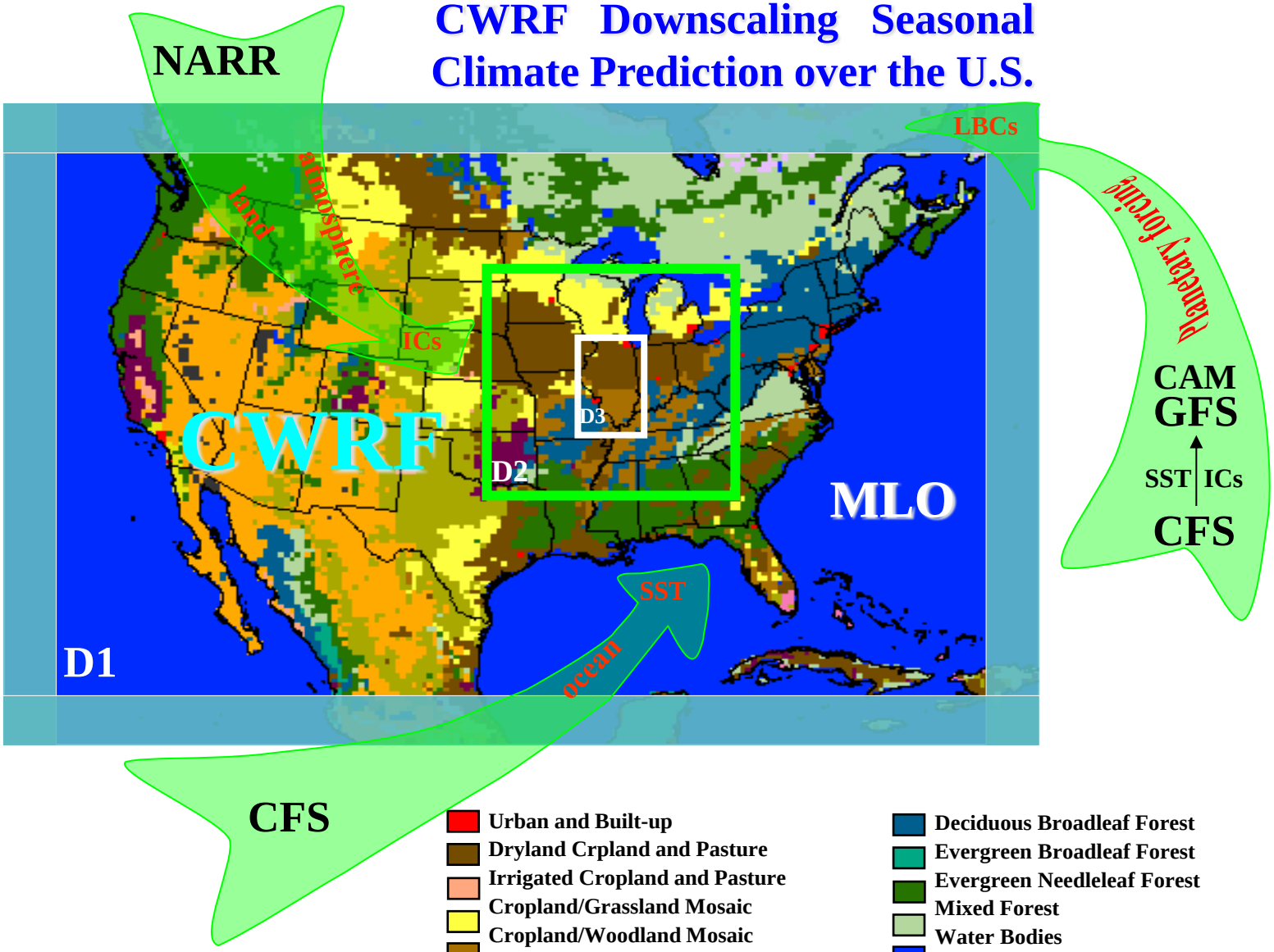
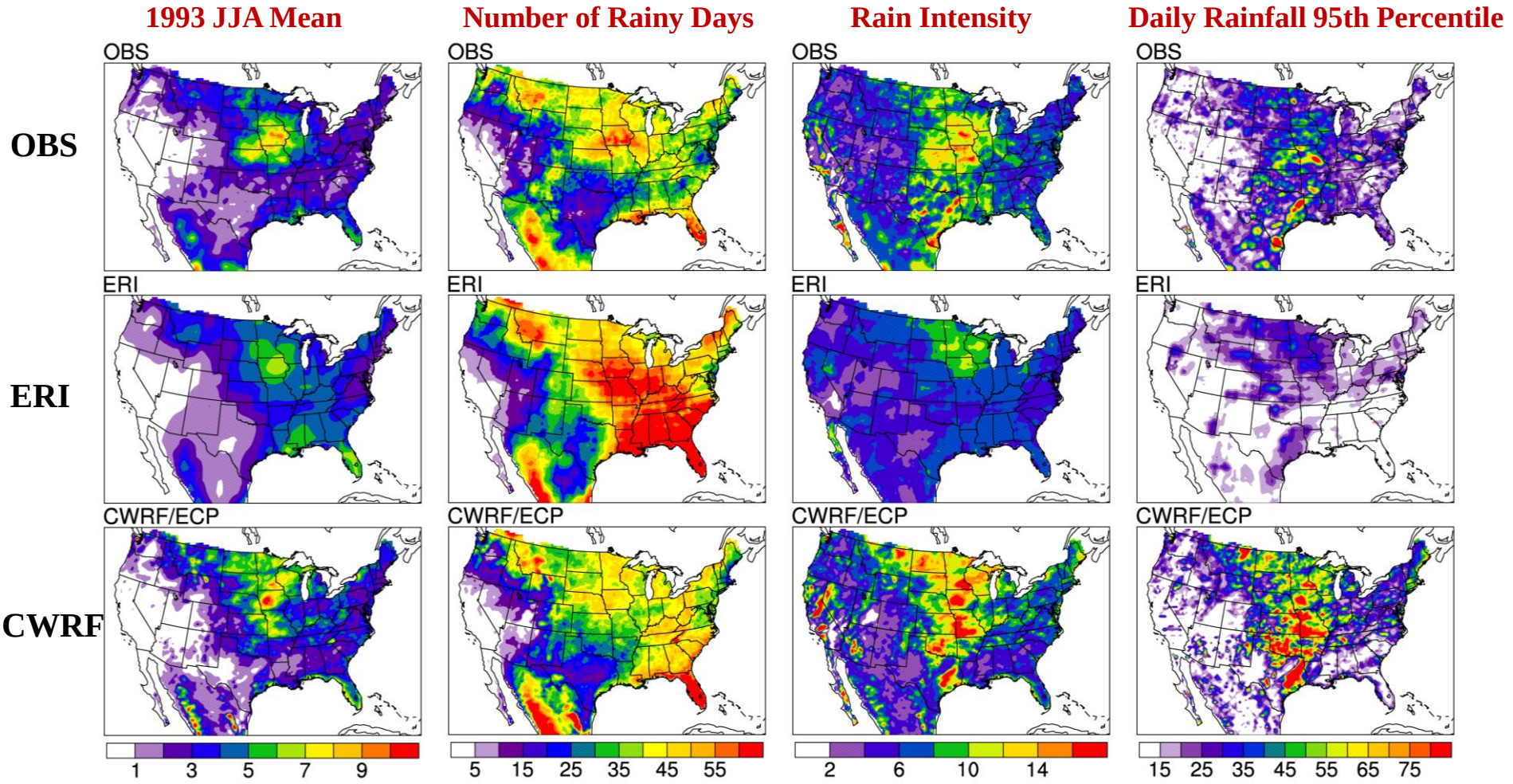
CWRF Downscaling Seasonal Climate Prediction over the U.S.



NOAA

2008-2011

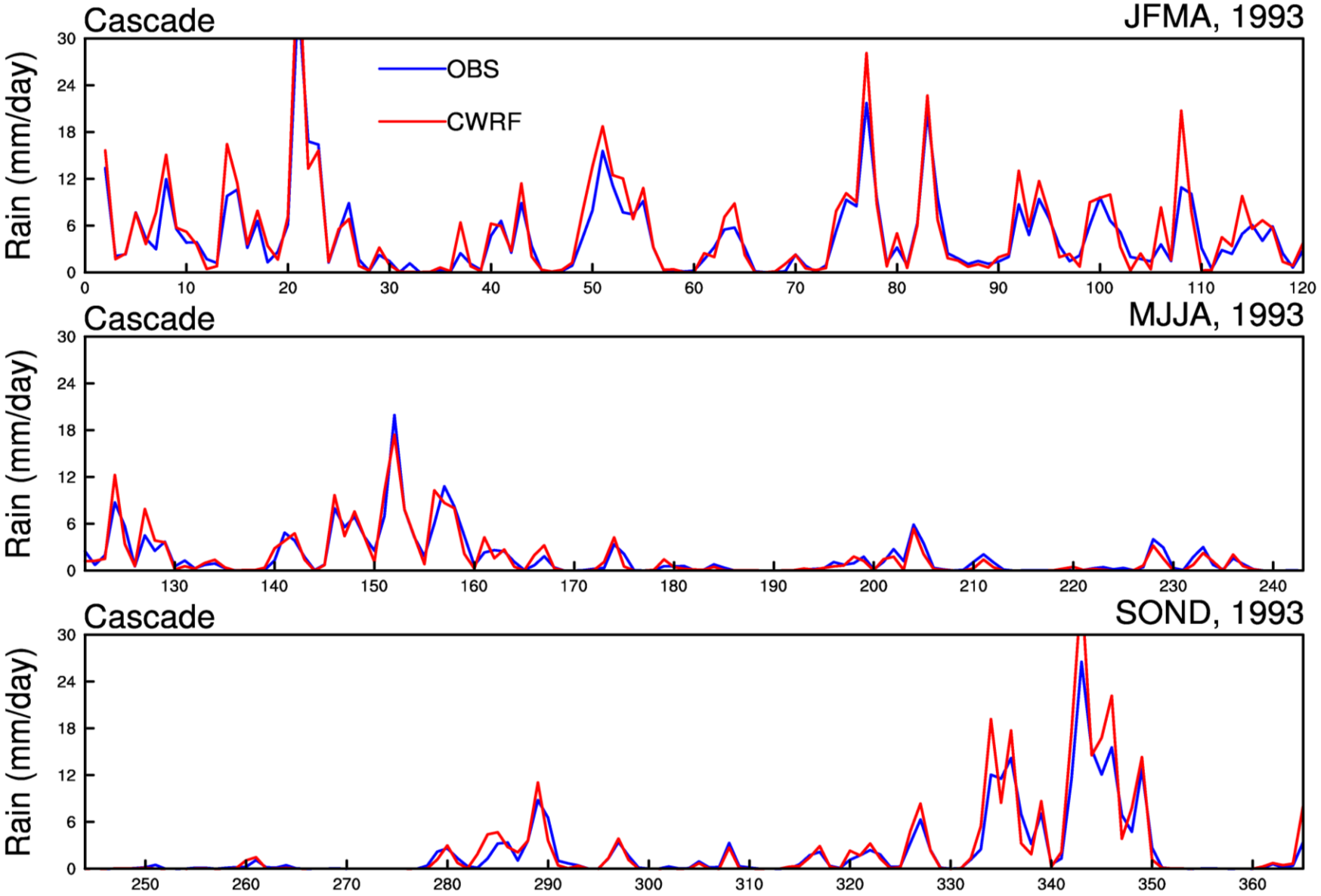
CWRF with ECP/W closure over the U.S. land



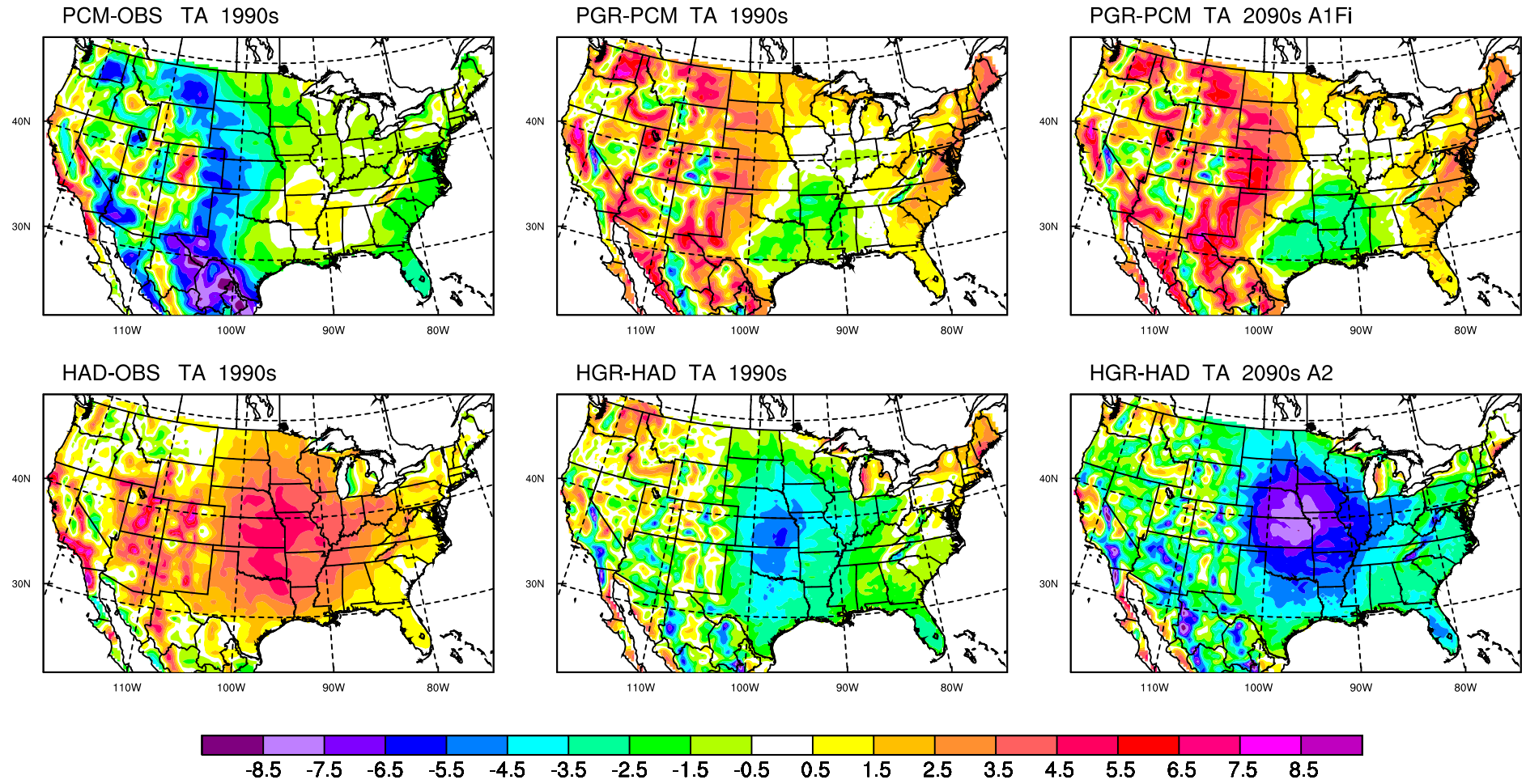
The reanalysis has already assimilated *local* observational data, while CWRF is driven by only LBCs. The CWRF skill will be enhanced if assimilating local data.

CWRF

Daily

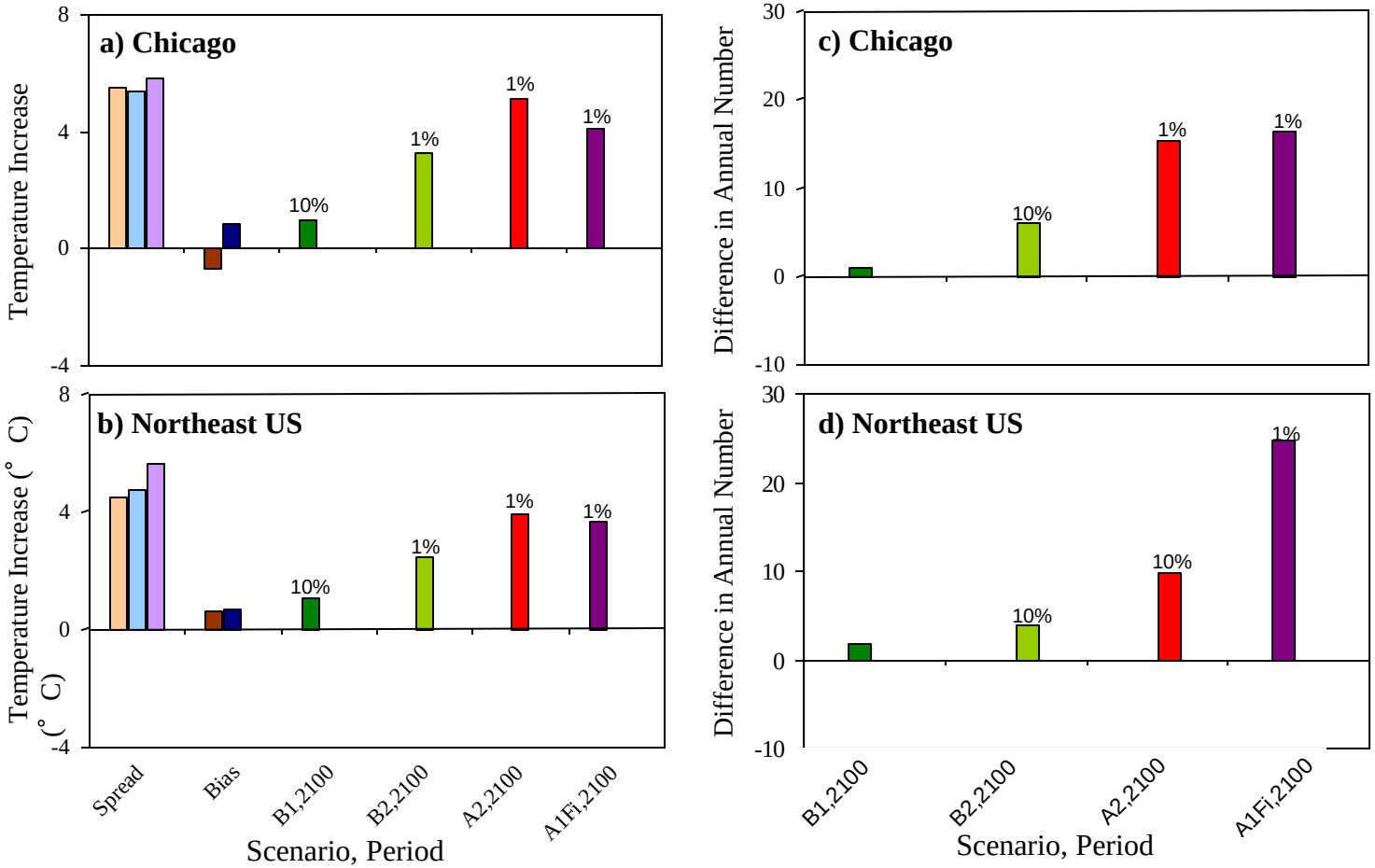

Cascade
JFMA, 1993
OBS
CWRF
Rain (mm/day)
Cascade
MJJA, 1993
Rain (mm/day)
Cascade
SOND, 1993
Rain (mm/day)

Propagation of GCM Present Climate Biases into Future Change Projections: Temperature



Adopt from Liang et al. (2008, GRL).

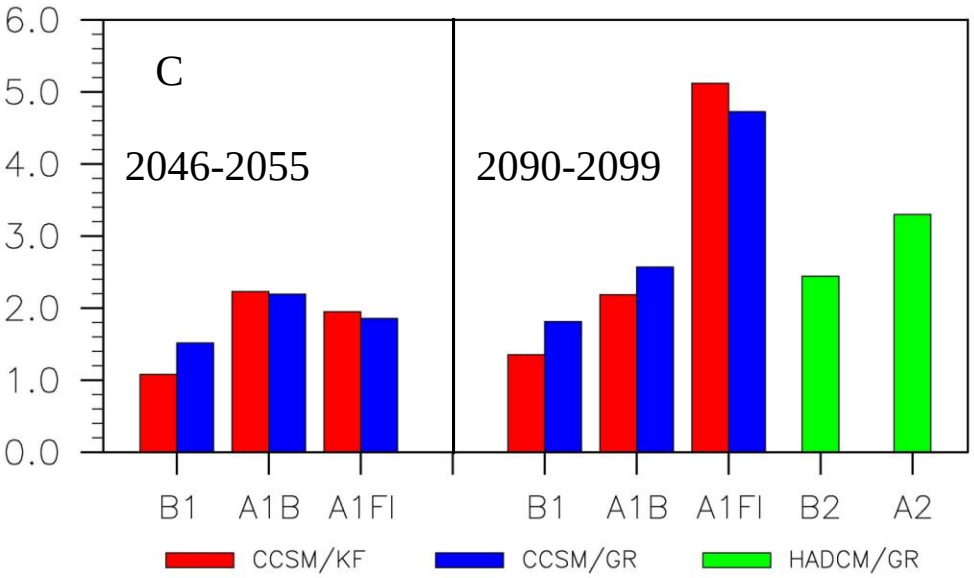
Projected U.S. Heat Wave Changes

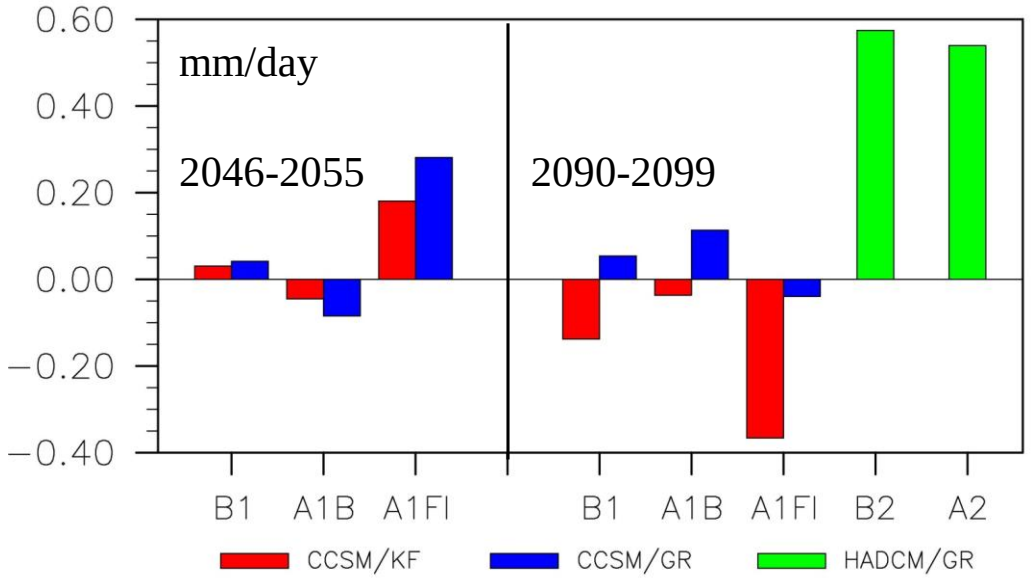


Projections of changes in the average annual 3-day heat wave temperature (° C) for a) Chicago and b) Northeast US and of the annual average number of heat wave days for c) Chicago and d) Northeast US. The two sets of bars on the far left side of a) and b) compare the present-day annual 3-day heat wave temperature spread (from its own summer mean temperature as simulated and observed); and model biases (from observations). The simulations are arranged from left to right in order of increasing greenhouse gas concentrations. The % number at the bar top depicts the corresponding statistical significance level.

Kunkel, K.E., X.-Z. Liang, and J. Zhu, 2010: Regional climate model projections and uncertainties of U.S. summer heat waves. *J. Climate*, **23**, 4447-4458.

RCM Projected Temperature & Precipitation Future Changes at Smaller Scales





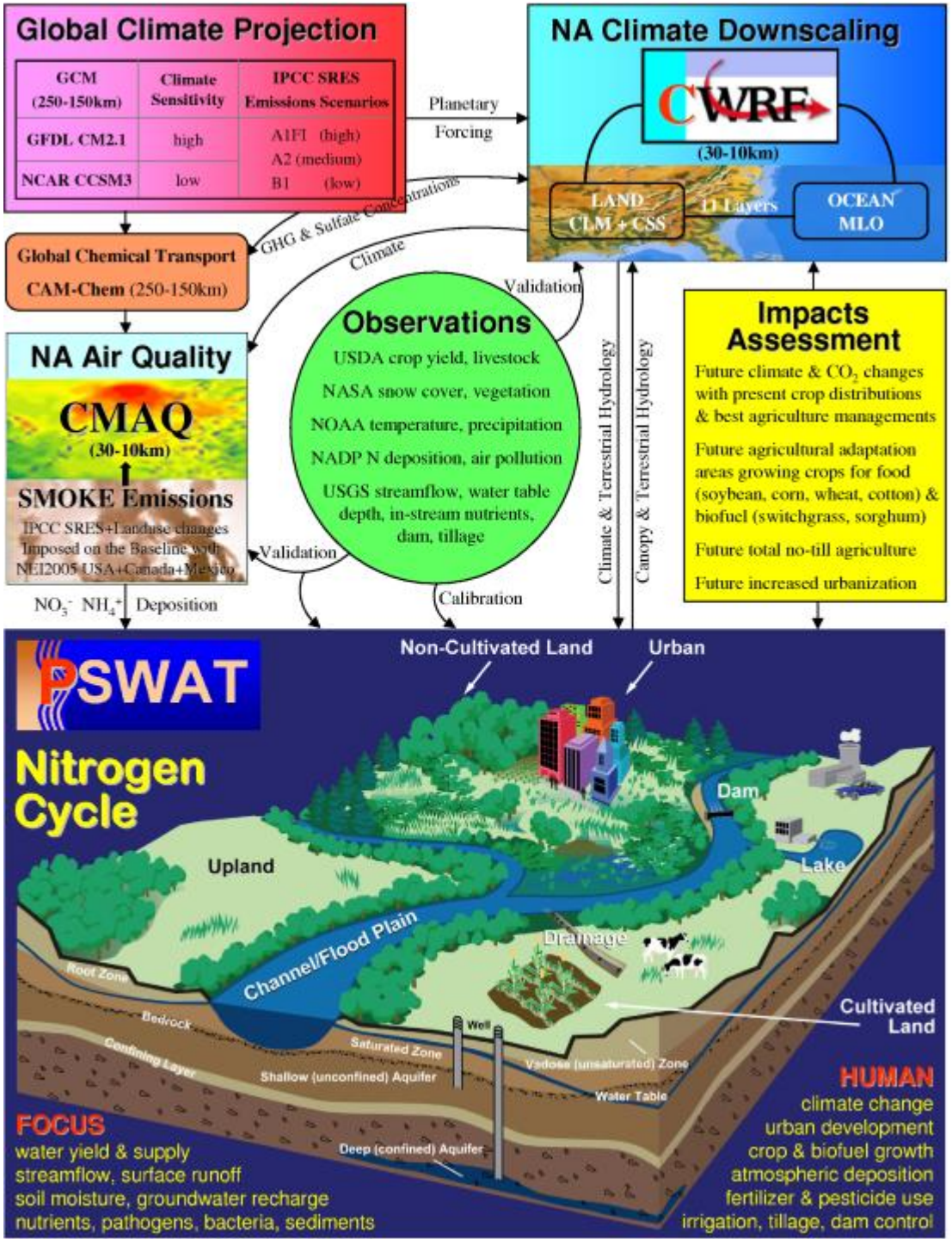
EPA STAR 2003-2011

FOCUS

Consolidate O_3

Elaborate PM

Explore Hg



EPA STAR 2009-2012

FOCUS

Nutrients

Pathogens

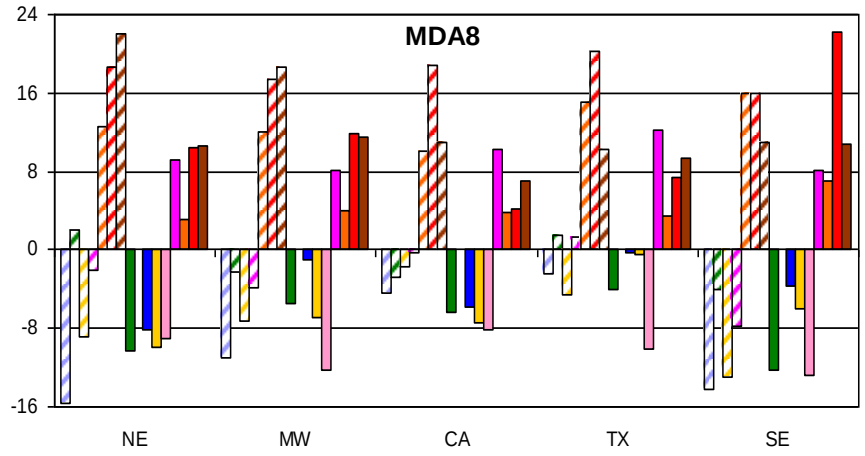
Bacteria

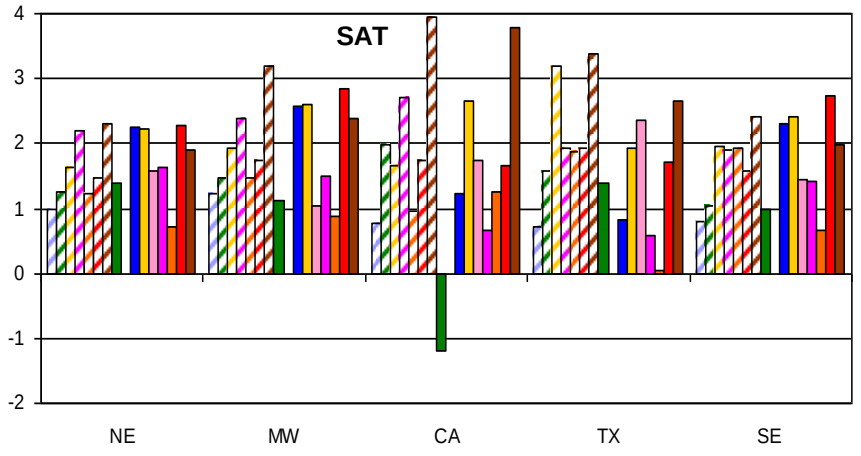
Sediments

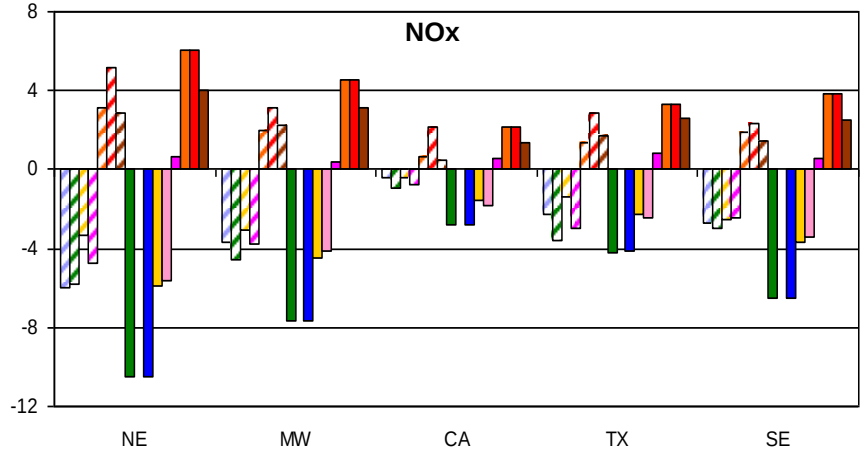
Agriculture

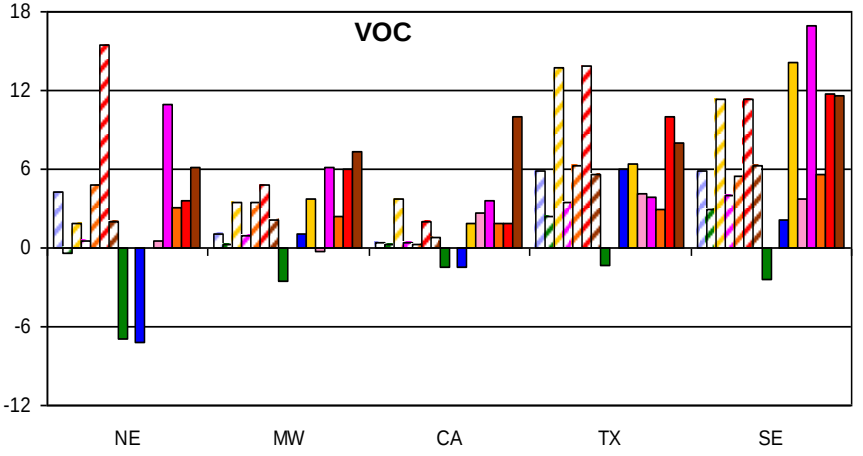
Urban

Projected O_3 Changes in 2050s



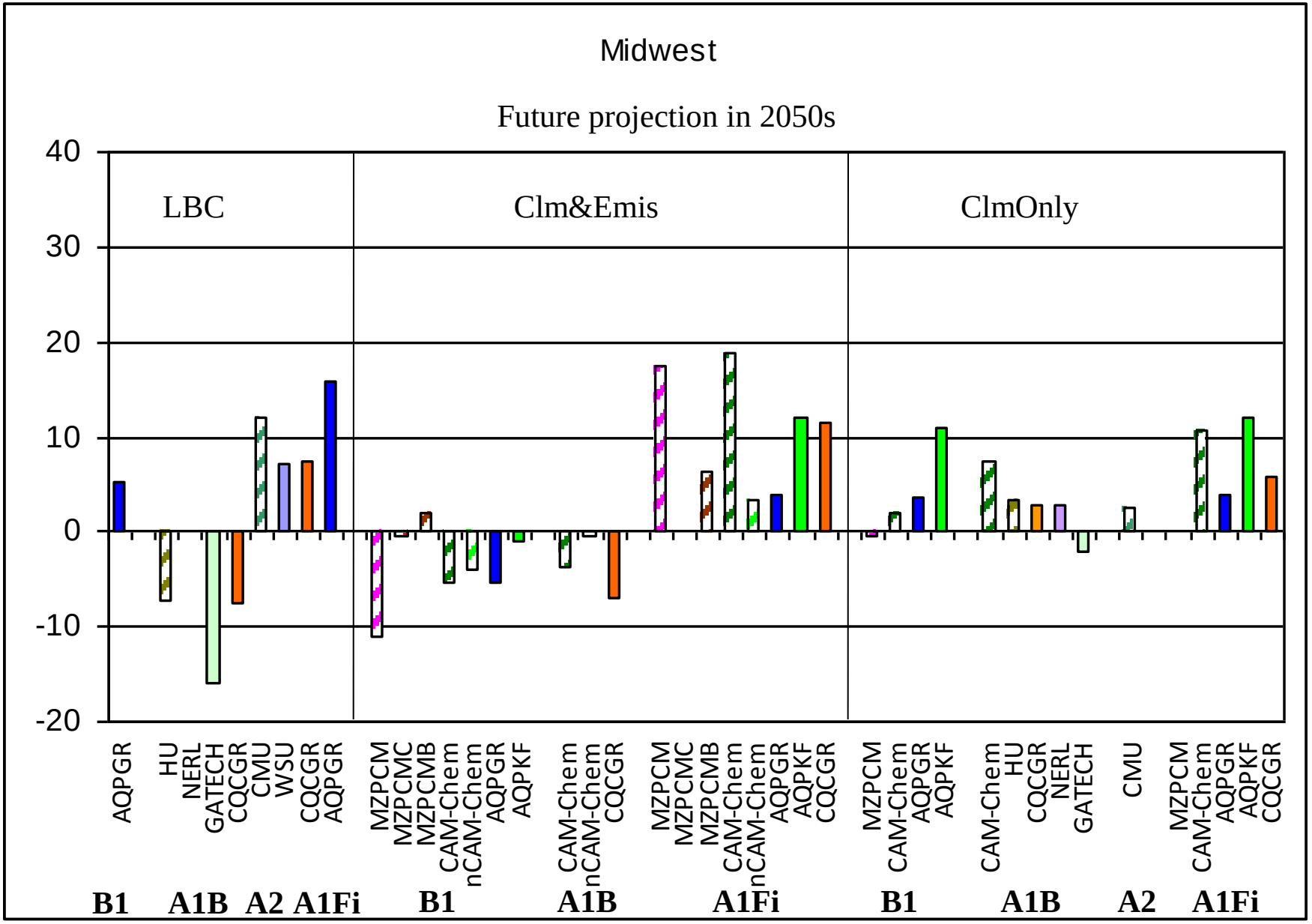




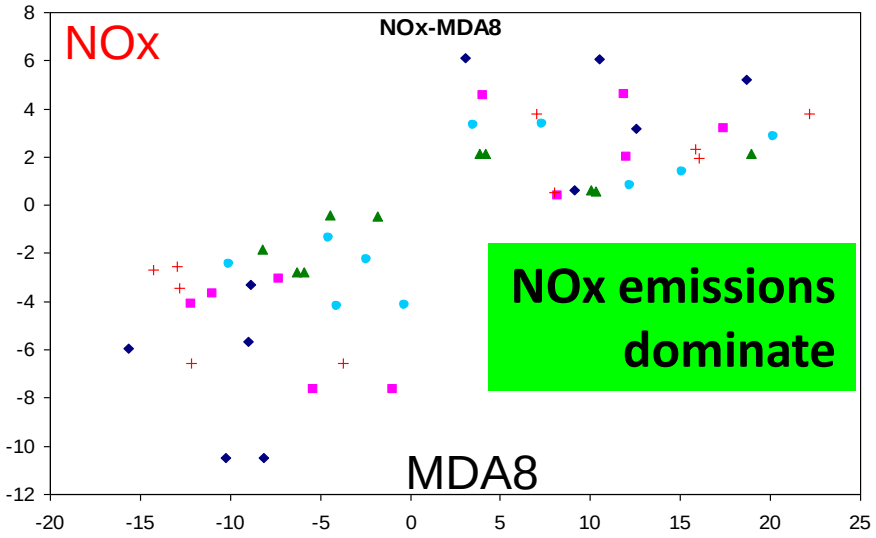


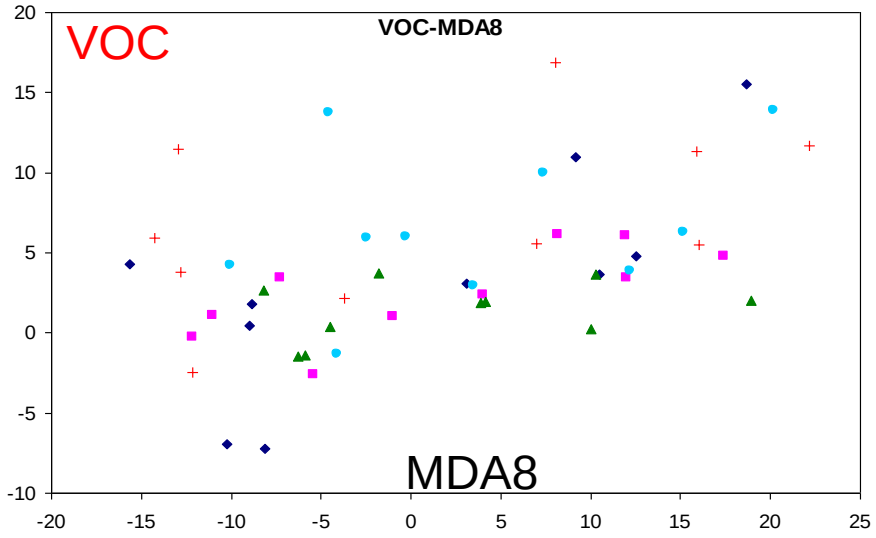
PCM.B1 CCSM.B1 Harvard.A1B CCSM.A1B CMU.A2 PCM.A1FI CCSM.A1FI PGR.B1 PKF.B1 CGR.A1B NERL.A1B WSU.A2 PGR.A1FI PKF.A1FI CGR.A1FI

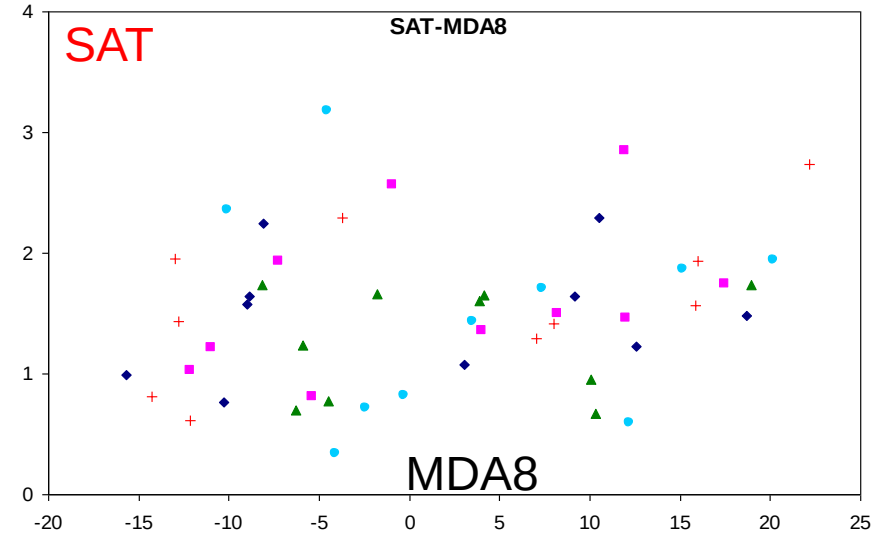
Regional MD8A [O_3] Future Projection

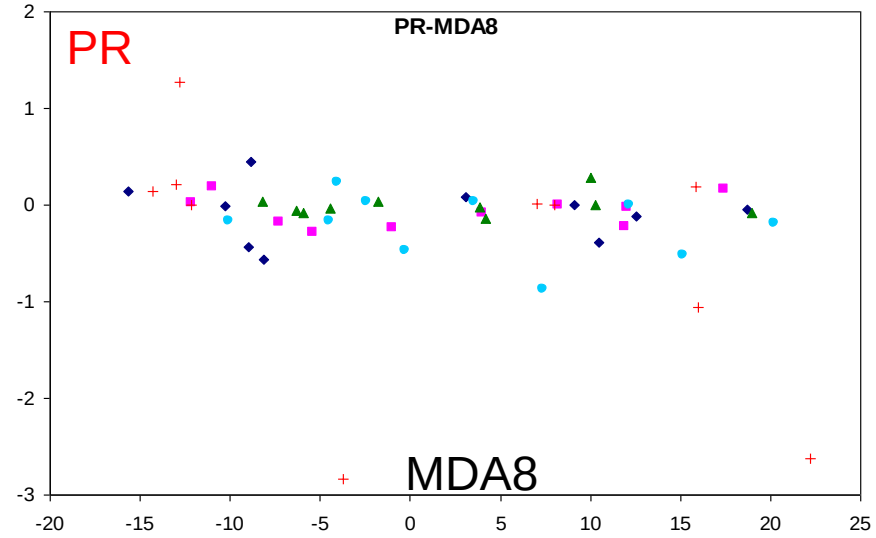


Factors for Ozone Changes



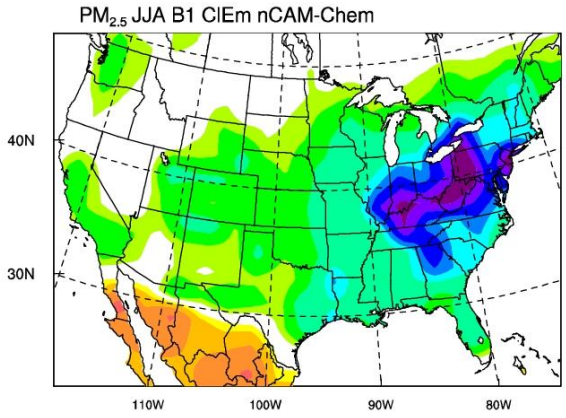


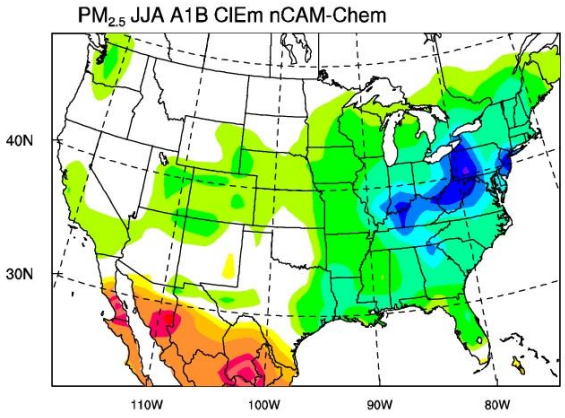


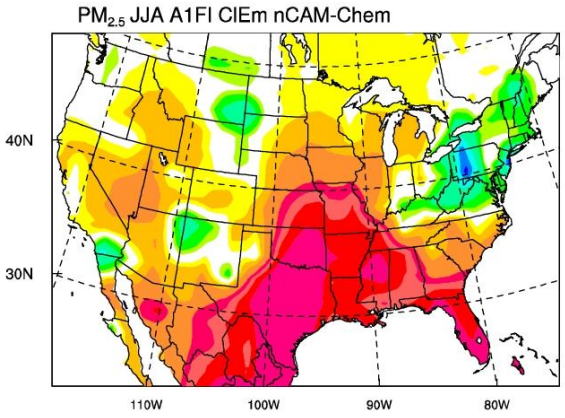


◆ NE ■ MW ▲ CA ● TX + SE

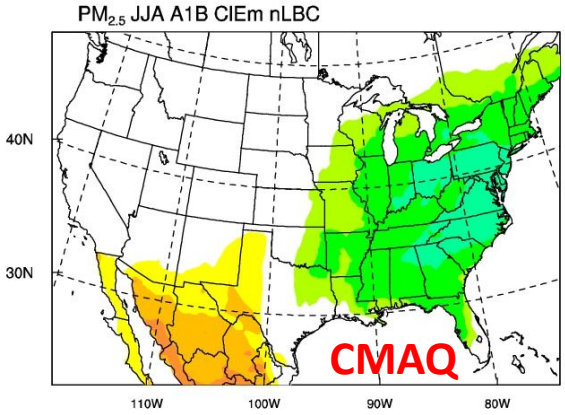
Projected PM2.5 Changes in 2050s







Dust aerosols play a substantial role in projecting PM2.5 changes

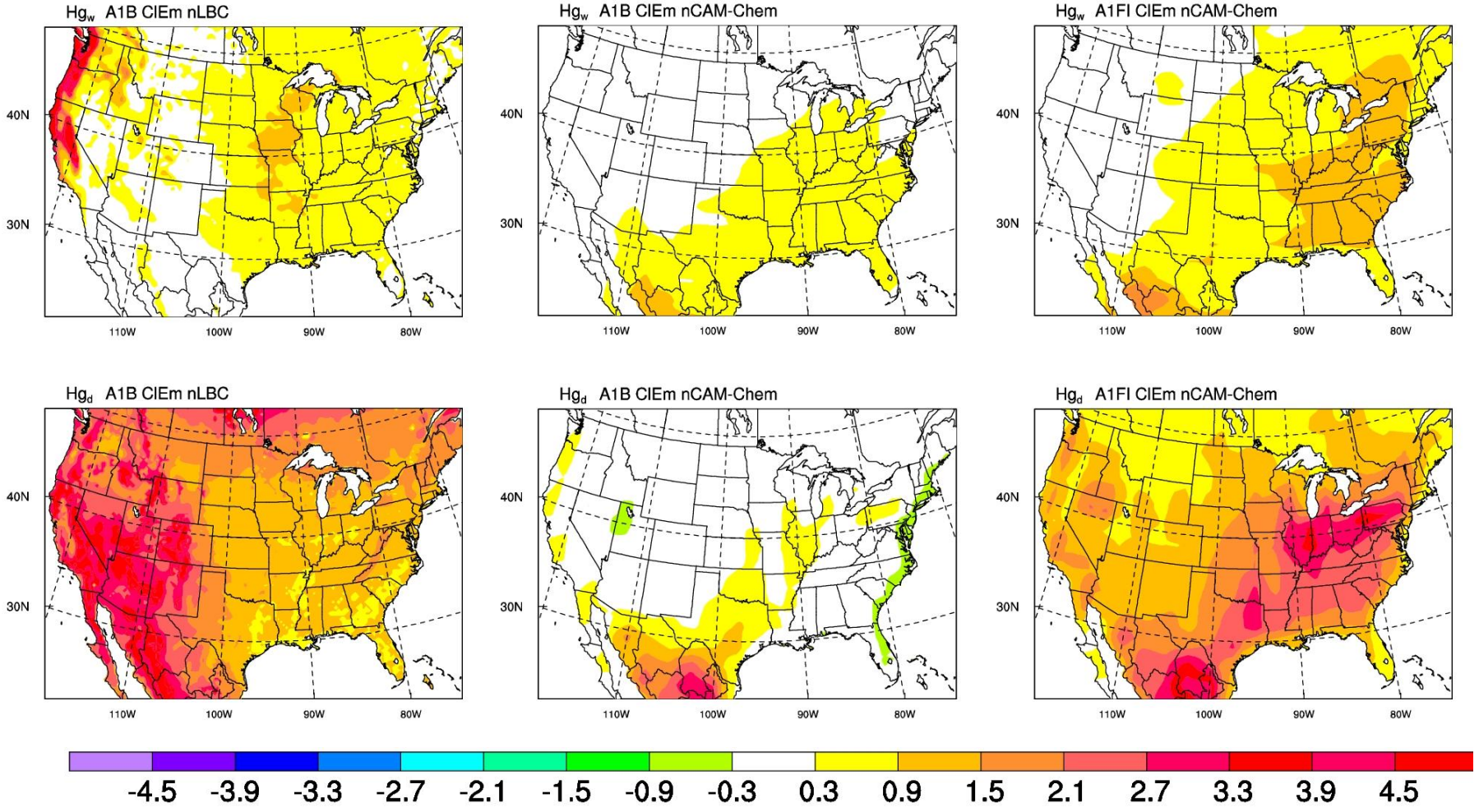


They also amplifies the sensitivity of PM2.5 changes to future emissions

CAM-Chem + PDAM

Projected Mercury Changes in 2050s

Emissions matter much; CMAQ enhances regional changes

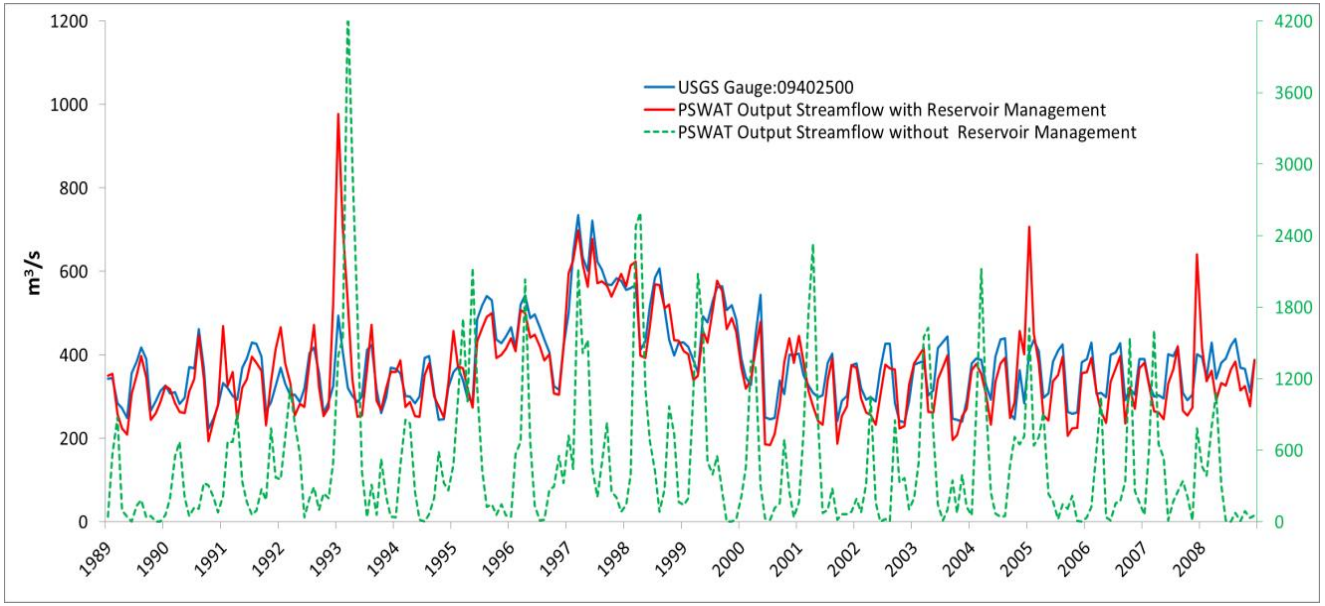


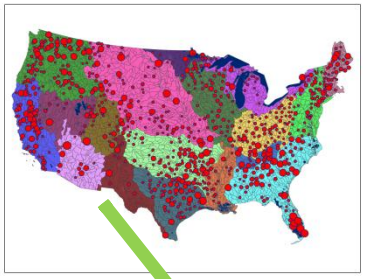
Changes in annual wet and dry deposition flux of all forms of mercury (μg m^{-2})

Simulating Human Management

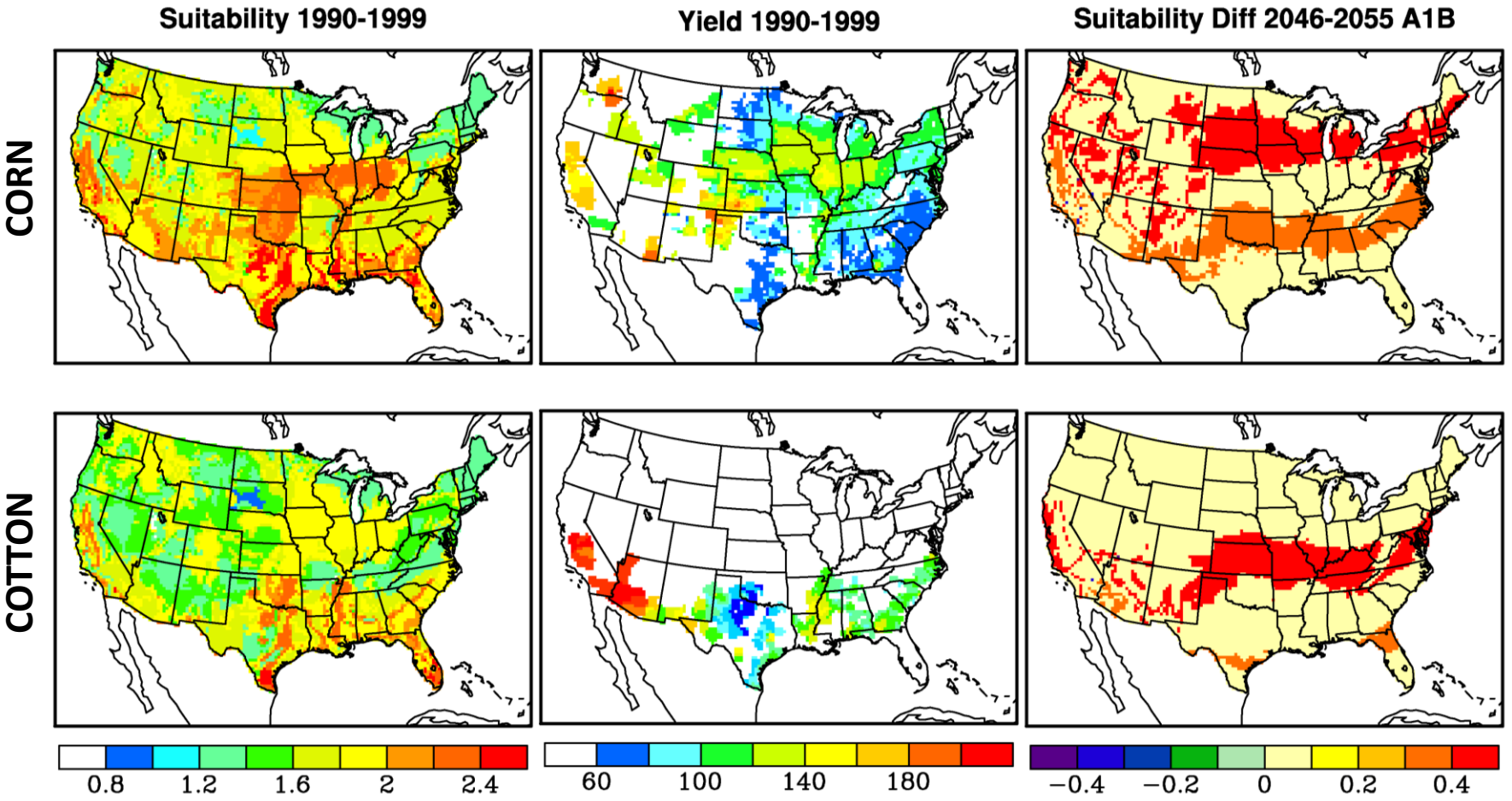
from Historical Records to Future Predictions

- Numerical schemes in macroscale hydrological models for simulating reservoir outflow, irrigation, and other management strategies are very limited, especially lacking operation-based predictive schemes
- We have developed such a predictive scheme for
  - Reservoir management
  - Irrigation
  - Point sources, non point sources





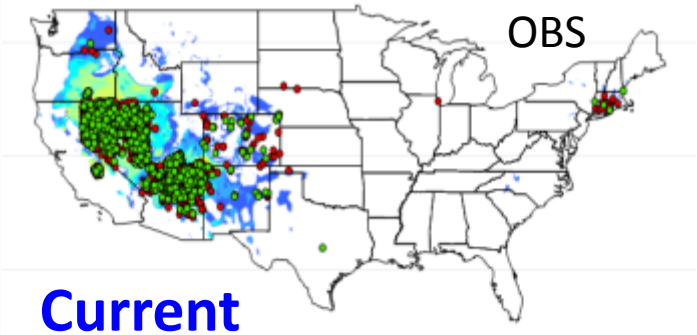
CDAS Preliminary Result



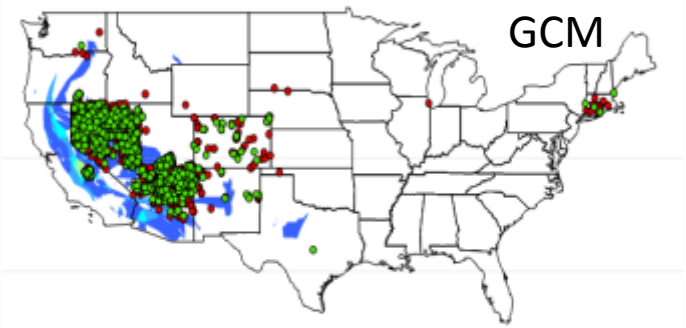
Crop Distribution, Adaptation, and Suitability Model (CDAS)

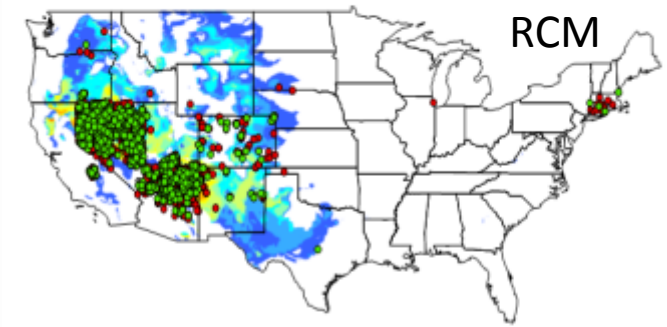
Cheatgrass Invasion in A1Fi 2050s

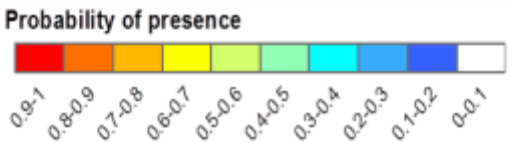
Invasive Species



Current







RCM improves modeling the current distribution and projects different future invasion than GCM

Future